polarized light output of the beam splitter, full voltage would provide a 0° rotation while a 90° rotation would result from the unpowered state.

[**0018**] In other embodiments, if the 2nd lamp were to be a backup lamp to replace the 1st lamp in the event of failure, switching between lamps could automatically switch the lamp ballast from the 1st lamp to the 2nd lamp. A system could be devised whereby the failure of the 1st lamp could automatically switch the ballast to the second lamp and cause the rotator to an alignment that was the inverse of its original setting.

[**0019**] In yet another variation, the 1st lamp might be a high intensity day use lamp while the 2nd lamp might be a low intensity lamp, intended for night use. For military uses, the 2nd lamp could be filtered for NVIS compatibility. In this case, the lamps could be powered individually or could be powered simultaneously, with the polarization rotator selecting which lamp would be the illumination source.

[**0020**] The novel features which are characteristic of the invention, both as to structure and method of operation thereof, together with further objects and advantages thereof, will be understood from the following description, considered in connection with the accompanying drawings, in which the preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and they are not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[**0021**] **FIG. 1** is a diagram of a preferred embodiment of a dual lamp system according to the present invention;

[**0022**] **FIG. 2** shows an electronic polarization rotator according to an alternative embodiment of the present invention;

[**0023**] **FIG. 3** shows an alternative electronic polarization rotator using a twisted nematic LCD;

[**0024**] **FIG. 4** is a diagram of a system in which lamp failure is automatically sensed; and

[**0025**] **FIG. 5** is a diagram of an alternative system in which the first lamp is a day lamp and the second lamp is a night lamp.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[**0026**] Turning first to **FIG. 1**, there is shown a dual lamp system **10** according to a preferred embodiment of the present invention. Two lamps **12**, **14**, are placed on adjacent sides of a polarizing beam splitter (PBS) **16**. The PBS **16** transmits the p-polarized component of incident light and reflects the s-polarized component from the first lamp **12**. If the first lamp **12** is on, a polarization rotator **18** is set by a mechanical driver device **20** to 0° rotation and the p-component of the first lamp **12** emission is transmitted through an output p-polarizer **22** and onward to the rest of the projection system.

[**0027**] The polarization rotator **18** can also be used to dim the light output from the first lamp **12**, considering that the light exiting the PBS **16** from that lamp is p-polarized. If the polarization rotator **18** is set to 0° rotation, then this p-polarized light passes with high efficiency through the output polarizer **22**.

[**0028**] As drive device **20** rotates the polarization rotator **18**, its output is gradually transformed into light with an increasing ratio of s- to p-polarization, of which only the latter is transmitted through the output polarizer **22**. The s-polarized light is absorbed in the output polarizer **22**.

[**0029**] Thus, at 90° rotation, essentially none of the light from the first lamp **12** is transmitted through the output polarizer **22**. Hence the polarization rotator **18** serves as a dimmer for first lamp **12** emission.

[**0030**] Consider now the case where the first lamp **12** is turned off or has failed and second lamp **14** is turned on. Here the s-component of second lamp **14** emission is reflected from the PBS **16** (toward the projection system). For this light to be transmitted through the output polarizer **22**, it must be converted to p-polarization. This is done by driving the polarization rotator **18** to 90° rotation, which then becomes the condition for maximum transmittance of second lamp **14** emission. In an inverse manner than for first lamp **12**, the polarization rotator can be used to dim the second lamp **14** emission by adjusting its rotation toward 0°.

[**0031**] The polarization rotator **18** can be mechanized in many different ways. In the simplest embodiment, it is simply a half wave plate which is mechanically rotated by drive means **20**. It is known that a half-wave plate has the property of rotating polarized light symmetrically around its slow axis. Thus, for example, setting the axis of the half-wave plate to 45° with respect to the polarized light output of the PBS **16** would result in a net rotation of light by 90°.

[**0032**] As shown in **FIG. 2, a** polarization rotator has no moving parts This might be preferred in many applications and can be mechanized with liquid crystal devices (LCDs). For example, an untwisted nematic LCD **28** with its director axis set at 45° to the polarized light from the PBS **16'** can be designed to be a half-wave retarder in the unpowered state, thereby acting as a 90° rotator in this state. As the RMS voltage applied by control circuits **30** to the LCD **28** is increased, the retardation is gradually reduced toward zero, so that in its fully-on state the LCD **28** is essentially a 0° rotator.

[**0033**] Similarly, and as shown in **FIG. 3, a** twisted nematic (TN) LCD **28'** can serve the same function. A TN LCD **28'** acts via optical waveguiding to control the polarization of light transmitted through it as a function of applied RMS voltage. In this application, the TN LCD **28'** would be constructed with a 90° twist and its director axis (at either substrate) would be aligned to be in line with the polarized light out of the PBS **16'**. Full voltage would correspond to 0° polarization rotation. Zero voltage would correspond to 90° polarization rotation.

[**0034**] If a system were designed for redundancy (backup lamp in the event of failure) as shown in **FIG. 4**, then one need only supply a single ballast **60** for both the first lamp **62** and second lamp **64**. Switching between lamps **62**, **64** could be automatic in the event of lamp failure.

[**0035**] For example, a sensor **66** could monitor the illumination from the first lamp **62**. The sensor output signal could be applied to a switch circuit **68** which normally